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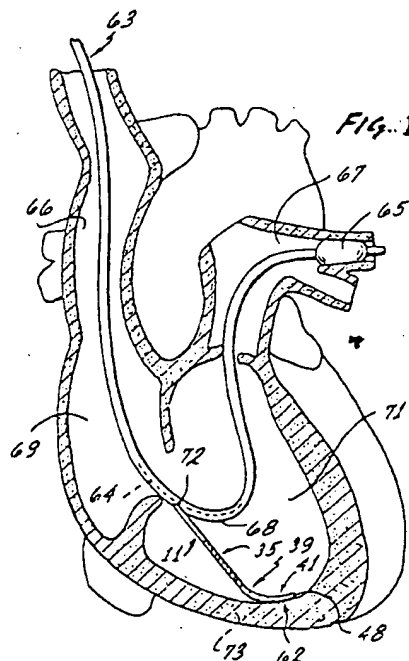
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(54) **Guiding catheter.**

(57) A guiding catheter, especially for use with a pacing catheter including an elongated catheter body 63 having proximal and distal ends, at least one lumen extending longitudinally in the body 63 and a port 72 extending from a lumen to the exterior of the catheter body 63, said port 72 being in the right heart when the catheter extends through the right heart to the pulmonary artery, said guiding catheter including an elongated stiffening element 64 extending from a location on the proximal side of said port 72 to a location on the distal side of said port 72, said stiffening element 64 being flexible but sufficiently stiff to cause the catheter to be gently curved without forming a kink when the catheter extends through the right ventricle to the pulmonary artery.

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This invention provides a guiding catheter by means of which a flexible pacing catheter can be introduced into the heart of the patient.

The invention provides a guiding catheter which readily forms into a gentle bend or curve in heart and does not kink when used with a pacing catheter. One reason that a composite catheter system tends to kink is that the catheter system proximally of the port out of which the pacing catheter emerges is relatively stiff, and the guiding catheter distally of the port is relatively flexible. This abrupt change in stiffness at the port tends to cause kinking of the guiding catheter.

With this invention, a stiffening element, such as an elongated polymeric or metallic wire, is permanently fixed, as by bonding, within the guiding catheter. The stiffening element begins proximally of the port and extends to a location distally of the port so that the region through the port and distally thereof is stiffened. The degree of stiffening is such as to permit the guiding catheter to form into the desired gentle curve without kinking. Preferably, the stiffening element terminates no farther distally than the right ventricle and no farther proximally than the superior vena cava, when the catheter system is used for pacing the right ventricle, the stiffening element preferably terminates at its opposite ends in the right atrium and the right ventricle.

The guiding catheter of the invention may for example, be used in conjunction with a pacing catheter as described in EP-A-0109178, from which this application is divided.

The invention, together with additional features and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying illustrative drawing, in which Fig.1 is a sectional view through a human heart showing one form of catheter according to the invention and the way in which it can be used.

Fig. 1. shows the guiding catheter of the invention.

Except for a stiffening element 64, the guiding catheter 63 may be of conventional construction and may be a Swan-Ganz thermodilution catheter which is available from American Edwards Laboratories of Irvine, California. The guiding catheter 63, which may have multiple lumens extending longitudinally through a catheter body, may be inserted into the heart through a vein using conventional techniques, and following such insertion, a balloon 65 adjacent the distal end of the guiding catheter is lodged in the pulmonary artery 67. As shown in Fig.1, the catheter 63 extends through the superior vena cava 66 and is formed into a curve 68 of about 180 degrees as it extends through the right atrium 69 and the right ventricle 71. The guiding

catheter 63 has a port 72 leading from one of its lumens into the right ventricle 71.

In the embodiment illustrated, the stiffening element 64 is in the form of an elongated, flexible, resilient wire of metal or plastic bonded into the guiding catheter 63 outside of the lumen with which the port 72 communicates. In the preferred construction illustrated, the stiffening element 64 extends from a location in the right atrium 69 proximally of the port 72 continuously to a location in the right ventricle 71 located distally of the port 72. Thus, regions of the guiding catheter on the opposite sides of the ports 72 are stiffened, and such stiffening is controlled to cause the catheter 63 to form the relatively gentle curve 68 in the right heart without kinking as the catheter extends through the right heart to the pulmonary artery 67.

With the guiding catheter 63, positioned in the right heart as shown in Fig.1 a pacing catheter 11 of the type described in EP-A-0109178 can be inserted through a lumen of the guiding catheter 63 and out the port 72.

## Claims

### 1. An apparatus comprising :

a guiding catheter adapted to be passed through the right side of the heart into the pulmonary artery;

said guiding catheter including an elongated catheter body having proximal and distal ends, at least one lumen extending longitudinally in the body and a port extending from the lumen to the exterior of the catheter body, said port being in the right heart when the catheter extends through the right heart to the pulmonary artery;

said guiding catheter including an elongated stiffening element permanently fixed within the catheter body and extending from a location on the proximal side of said port to a location on the distal side of said port, said stiffening element being flexible but sufficiently stiff to cause the catheter to be gently curved without forming a kink when the catheter extends through the right ventricle to the pulmonary artery; and

said lumen being adapted to have an inner catheter passed through the lumen and the port into the right heart.

### 2. Apparatus according to claim 1 including an inner catheter extending through said lumen and passing through said port, said inner cath-

eter including a pacing catheter having at least one electrode.

3. Apparatus according to claim 1 or claim 2, wherein said stiffening element extends no further proximally than the superior vena cava and no further distally than the right ventricle, when the guiding catheter extends through the right heart to the pulmonary artery. 5
4. Apparatus according to any one of claims 1 to 3, wherein said locations are spaced substantially from the ends of the guiding catheter. 10
5. Apparatus according to any one of claims 1 to 4, wherein the stiffening element is bonded into the catheter body. 15
6. Apparatus according to any one of claims 1 to 5, wherein said port generally faces the outside of said curve. 20
7. Apparatus according to any one of claims 1 to 6, wherein said stiffening element extends further distally than proximally of said port. 25

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